*In this technological age,* mathematics is more important than ever. When students leave school, they are more and more likely to use mathematics in their work and everyday lives — operating computer equipment, planning timelines and schedules, reading and interpreting data, comparing prices, managing personal finances, and completing other problem-solving tasks. What they learn in mathematics and how they learn it will provide an excellent preparation for a challenging and ever-changing future.

***The state of Indiana has established the following mathematics standards to make clear to teachers, students, and parents what knowledge, understanding, and skills students should acquire in Grade 1:***

## Standard 1 — Number Sense

Understanding the number system is the basis of mathematics. Students develop this understanding by first counting sets of objects and then moving on to writing numbers in figures. They learn how we group numbers in tens and ones, allowing them to write numbers up to 100. They find the number one more or one less than a given number. They put numbers up to 10 in order of size and use the terms *first*, *second*, *third*, etc. Students also learn about fractions, understanding that fractions compare a part of a set to the whole set.

## Standard 2 — Computation

Fluency in computation is essential. As students learn about the whole numbers up to 100, they also learn how to add and subtract them. They use objects to join sets together (for addition) and to remove objects from sets (for subtraction). They become familiar with different ways of looking at the same number using objects and figures. They also learn that addition and subtraction are opposites of each other and that zero has special properties.

## Standard 3 — Algebra and Functions

Algebra is a language of patterns, rules, and symbols. Students at this level relate word problems to number sentences in symbols, such as $7 + 6 = 13$, and learn some of the rules relating addition and subtraction. They also continue number patterns using addition.

## Standard 4 — Geometry

Students learn about geometric shapes and develop a sense of space. They describe and draw simple shapes, comparing and sorting them by such attributes as size and number of sides. They learn the meaning of words, like *near* and *behind*, that relate to positions in space and use them to give and follow directions. They identify objects as two- or three-dimensional and describe the faces of solid objects. They also recognize geometric shapes in the world around them.

## Standard 5 — Measurement

The study of measurement is essential because of its uses in many aspects of everyday life. Students begin their study of measurement by comparing objects' length, weight, temperature, etc. Then they become more precise and find, for example, that the length of their desk is 8 pencil-lengths. From this, they move toward understanding the need for standard units of length: inch, foot, yard, centimeter, and meter. They learn how to tell the time on a clock to the nearest half hour. They also learn about money: the values of pennies, nickels, and dimes.

## Standard 6 — Problem Solving

In a general sense, mathematics is problem solving. In all mathematics, students use problem-solving skills: they choose how to approach a problem, they explain their reasoning, and they check their results. As they develop their skills with numbers, geometry, or measurement, for example, students at this level move from simple ideas to more complex ones by taking logical steps that build a better understanding of mathematics.

***As part of their instruction and assessment, students should also develop the following learning skills by Grade 12 that are woven throughout the mathematics standards:***

### Communication

The ability to read, write, listen, ask questions, think, and communicate about math will develop and deepen students' understanding of mathematical concepts. Students should read text, data, tables, and graphs with comprehension and understanding. Their writing should be detailed and coherent, and they should use correct mathematical vocabulary. Students should write to explain answers, justify mathematical reasoning, and describe problem-solving strategies.

### Reasoning and Proof

Mathematics is developed by using known ideas and concepts to develop others. Repeated addition becomes multiplication. Multiplication of numbers less than ten can be extended to numbers less than one hundred and then to the entire number system. Knowing how to find the area of a right triangle extends to all right triangles. Extending patterns, finding even numbers, developing formulas, and proving the Pythagorean Theorem are all examples of mathematical reasoning. Students should learn to observe, generalize, make assumptions from known information, and test their assumptions.

### Representation

The language of mathematics is expressed in words, symbols, formulas, equations, graphs, and data displays. The concept of one-fourth may be described as a quarter, $\frac{1}{4}$, one divided by four, 0.25, $\frac{1}{8} + \frac{1}{8}$, 25 percent, or an appropriately shaded portion of a pie graph. Higher-level mathematics involves the use of more powerful representations: exponents, logarithms, $\pi$, unknowns, statistical representation, algebraic and geometric expressions. Mathematical operations are expressed as representations: $+$, $=$, divide, square. Representations are dynamic tools for solving problems and communicating and expressing mathematical ideas and concepts.

### Connections

Connecting mathematical concepts includes linking new ideas to related ideas learned previously, helping students to see mathematics as a unified body of knowledge whose concepts build upon each other. Major emphasis should be given to ideas and concepts across mathematical content areas that help students see that mathematics is a web of closely connected ideas (algebra, geometry, the entire number system). Mathematics is also the common language of many other disciplines (science, technology, finance, social science, geography) and students should learn mathematical concepts used in those disciplines. Finally, students should connect their mathematical learning to appropriate real-world contexts.

**Standard 1**

# Number Sense

*Students understand symbols, objects, and pictures used to represent numbers up to 100 and show an understanding of fractions.*

1.1.1 Count, read, and write whole numbers* up to 100.

**Example:** Read "seventy-two" for the number 72.

1.1.2 Count and group objects in ones and tens.

**Example:** Separate a group of 34 blocks into three groups of 10 blocks and 4 single blocks.

1.1.3 Identify the number of tens and ones in numbers less than 100.

**Example:** How many tens and how many ones are in 56? Explain your answer.

1.1.4 Name the number that is one more than or one less than any number up to 100.

**Example:** Name the number one less than 78.

1.1.5 Compare whole numbers up to 10 and arrange them in numerical order.

**Example:** Arrange the numbers 5, 2, and 9 in order from greatest to least.

1.1.6 Match the number names (*first*, *second*, *third*, etc.) with an ordered set of up to 10 items.

**Example:** Point out the fifth child from the front of a line of children.

1.1.7 Recognize when a shape is divided into congruent (matching) parts.

**Example:** Given a rectangle with lines dividing it into parts, decide whether the parts are the same size.

1.1.8 For a shape divided into 8 or fewer congruent (matching) parts, describe a shaded portion as "__ out of __ parts" and write the fraction.

**Example:** Given a circle divided into 4 equal parts with 3 of the parts shaded, describe the shaded portion as "3 out of 4 parts" and write the fraction for the shaded portion.

1.1.9 For a set of 8 or fewer objects, describe a subset as "__ out of __ parts" and write the fraction.

**Example:** Given 3 red pencils and 2 blue pencils, describe the subset of red pencils as "3 out of 5 parts" and write the fraction of the pencils that are red.

1.1.10 Represent, compare, and interpret data using pictures and picture graphs.

**Example:** Use a picture graph to show how many dogs, cats, etc. your friends have. Which kind of pet appears most often? Explain your answer.

* whole number: 0, 1, 2, 3, etc.

**Standard 2**

# Computation

*Students demonstrate the meaning of addition and subtraction and use these operations to solve problems.*

1.2.1 Show the meaning of addition (putting together, increasing) using objects.

**Example:** Put together 3 pencils and 5 pencils. Tell how many pencils you have and explain what you are doing.

1.2.2 Show the meaning of subtraction (taking away, comparing, finding the difference) using objects.

**Example:** Take away 6 blocks from a group of 10. Tell how many blocks are left and explain what you are doing.

1.2.3 Show equivalent forms of the same number (up to 20) using objects, diagrams, and numbers.

**Example:** Write 15 as $8 + 7$, $5 + 5 + 5$, $10 + 5$, $15 + 0$, $17 - 2$, etc.

1.2.4 Demonstrate mastery of the addition facts (for totals up to 20) and the corresponding subtraction facts.

**Example:** Add $11 + 8$, subtract $16 - 9$, add $4 + 7$.

1.2.5 Understand the meaning of the symbols $+$, $-$, and $=$.

**Example:** Use symbols to write the number sentence "one added to three equals four."

1.2.6 Understand the role of zero in addition and subtraction.

**Example:** You start with 6 eggs and then give away 0 eggs. How many eggs do you have now?

1.2.7 Understand and use the inverse relationship between addition and subtraction facts (such as $4 + 2 = 6$, $6 - 2 = 4$, etc.) to solve simple problems.

**Example:** List three other facts using addition or subtraction that are related to $3 + 5 = 8$.

**Standard 3**

# Algebra and Functions

*Students use number sentences with the symbols $+$, $-$, and $=$ to solve problems.*

1.3.1 Write and solve number sentences from problem situations involving addition and subtraction.

**Example:** You have 3 pencils and your friend has 2 pencils. You want to know how many pencils you have altogether. Write a number sentence for this problem and use it to find the total number of pencils.

1.3.2 Create word problems that match given number sentences involving addition and subtraction.

**Example:** Tell a story or draw a picture for a problem that can be solved using the number sentence $3 + 6 = 9$.

1.3.3 Recognize and use the relationship between addition and subtraction.

**Example:** Start with 8 blocks. Add 5 more blocks. How many do you have? Now take away 5 blocks. How many do you have now? Explain your answer.

1.3.4 Create and extend number patterns using addition.

**Example:** A number pattern begins with these numbers: 1, 3, 5, …. Tell what the next number will be and explain how you decided on that number.

**Standard 4**

# Geometry

*Students identify common geometric shapes, classify them by common attributes, and describe their relative position or their location in space.*

1.4.1 Identify, describe, compare, sort, and draw triangles, rectangles, squares, and circles.

**Example:** Draw a square and a circle and write their names next to them.

1.4.2 Identify triangles, rectangles, squares, and circles as the faces* of three-dimensional objects.

**Example:** Look at a collection of solid objects and find triangles and squares on their sides.

1.4.3 Classify and sort familiar plane and solid objects by position, shape, size, roundness, and other attributes. Explain the rule used.

**Example:** Group a collection of objects by something they have in common. Explain your grouping.

1.4.4 Identify objects as two-dimensional or three-dimensional.

**Example:** Sort various objects (cube, square, triangle, prism) into the categories "two-dimensional" and "three-dimensional." Explain your choices.

1.4.5 Give and follow directions for finding a place or object.

**Example:** Show someone how to get to the school library by making a map or diagram.

1.4.6 Arrange and describe objects in space by position and direction: near, far, under, over, up, down, behind, in front of, next to, to the left or right of.

**Example:** Name objects that are near your desk and objects that are in front of it. Explain why there may be some objects in both groups.

1.4.7 Identify geometric shapes and structures in the environment and specify their location.

**Example:** Find as many rectangles as you can in your classroom. Record the rectangles that you found by making drawings or using a camera.

* face: a flat side, like the front of a cereal box

Standard 5

# Measurement

*Students learn how to measure length, as well as how to compare, order, and describe other kinds of measurement.*

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1.5.1 Measure the length of objects by repeating a nonstandard unit or a standard unit.

**Example:** Measure the length of your desk in pencil-lengths.

1.5.2 Use different units to measure the length of the same object and predict whether the measure will be greater or smaller when a different unit is used.

**Example:** If you measure your desk with a shorter pencil, will the number of pencil-lengths be more or less? Measure the desk to find out your answer.

1.5.3 Recognize the need for a fixed unit of length.

**Example:** Give students different lengths of string and have them measure the width of a doorway. Talk about why their answers are different and the kinds of problems this can cause.

1.5.4 Measure and estimate the length of an object to the nearest inch and centimeter.

**Example:** Have some students measure the width of the doorway in inches and some measure it in centimeters. Discuss why these are better ways of measuring than using the pieces of string.

1.5.5 Compare and order objects according to area, capacity, weight, and temperature, using direct comparison or a nonstandard unit.

**Example:** Use a scale or balance to see how many crayons weigh the same as a shoe.

1.5.6 Tell time to the nearest half-hour and relate time to events (before/after, shorter/longer).

**Example:** Is recess before or after lunch?

1.5.7 Identify and give the values of collections of pennies, nickels, and dimes.

**Example:** How many pennies have the same value as two nickels?

**Standard 6**

# Problem Solving

*Students make decisions about how to set up a problem.*

1.6.1 Choose the approach, materials, and strategies to use in solving problems.

**Example:** Solve the problem: "The number 10 can be written in different ways using addition: $10 = 4 + 6$ or $10 = 1 + 9$ … . Find how many ways you can write 10 by adding two numbers." Use blocks to set up the problem.

1.6.2 Use tools such as objects or drawings to model problems.

**Example:** In the first example, show the number 10 using addition of whole numbers by counting out ten blocks. Divide them into two piles and write a number sentence that shows the number in each pile of blocks.

*Students solve problems and justify their reasoning.*

1.6.3 Explain the reasoning used and justify the procedures selected in solving a problem.

**Example:** In the first example, make two piles of ten blocks; separate one block from the first pile and count the number of blocks left. Separate two blocks from the second pile and count the number left. Describe any pattern of numbers that you find.

1.6.4 Make precise calculations and check the validity of the results in the context of the problem.

**Example:** In the first example, check your results by setting out 10 blocks showing $1 + 9$, another 10 blocks showing $2 + 8$, and so on. Continue to count out piles of 10 blocks to find the total number of ways that ten blocks can be separated into two piles. Describe the patterns that you find and how you know that you have found all of them.

1.6.5 Understand and use connections between two problems.

**Example:** Use the problem you have just solved to find how many ways you can write 16 by adding two numbers.

# NOTES